Can You Imagine . . .

. . . a process that could help create automobile tires that provide better fuel efficiency, traction, and wear resistance.

APPLIED SCIENCES COLLABORATED WITH GENERAL MOTORS, GOODYEAR, AND OTHERS TO DEVELOP THEIR INNOVATIVE PROCESS.

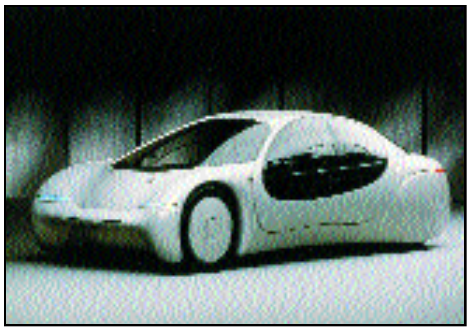
LOW-COST STRUCTURAL COMPOSITES MAY SOON HIT THE HIGHWAY

Composite materials are essential to the automotive industry's drive toward cars that are lighter, stronger, and more fuel efficient than their predecessors. Perhaps the most promising of these materials are carbon fiber composites. Stronger than steel, stiffer than titanium, and lighter than aluminum, carbon fibers could be added to a range of automobile components, giving them exceptional mechanical properties while significantly reducing their weight.

These enhanced properties come at a cost, however. Carbon fiber material costs much more than competing fibers and requires complex manufacturing processes. Such roadblocks have slammed the brakes on the use of carbon fiber composites in the automotive industry.

In a collaboration with General Motors Corporation, the Goodyear Tire & Rubber Company, and others, Applied Sciences, Inc. (Cedarville, OH), introduced a low-cost, high-volume process to produce vapor-grown carbon fibers (VGCFs). Developed with the help of BMDO SBIR contracts, VGCFs' range of properties—including high strength and light weight—make them an attractive fiber reinforcement in advanced composites. According to a survey conducted for Applied Sciences, VGCFs could cost less than $5 per pound when produced at capacities greater than 10 million pounds per year. Competing fiber reinforcements cost $100 per pound.

The National Institute of Standards and Technology's Advanced Technology Program recently awarded matching funds to the new development program, which also includes the Gas Research Institute, EMTEC, and GM Delphi Chassis Systems. The program will develop VGCF composites for automotive applications and address the technical hurdles associated with scaling the process to high-volume production.



■ The GM Ultralite, pictured above, epitomizes the objectives of Applied Sciences' work with GM and Goodyear. This 1,400-pound vehicle's fuel economy (100 miles per gallon) is achieved using carbon fiber composites combined with efficient powertrain and chassis systems.

One potential automotive application is in tires that provide better fuel efficiency, traction, and wear resistance. Economical production of VGCF composites could also help car makers reduce vehicle weight up to 132 pounds. Members of the venture also seek to develop VGCF anodes for lithium-ion batteries, which are attractive for all-electric vehicles because they can provide high specific power, high specific energy, and long cycle lifetimes.

Applied Sciences has also explored other applications for VGCFs; their high thermal and electrical conductivity make them attractive as battery electrodes, microelectronic substrates, electromagnetic shielding, and static reduction composites. The company currently markets four products, and two more are nearly ready.

The BMDO SBIR program funded early development of Applied Science's VGCF technology in six projects, two of which received Phase II funding. These programs focused on developing VGCFs for electromagnetic railguns and for other structural, thermal, and electronic applications.

ABOUT THE TECHNOLOGY

Introducing gas-phase catalysts into a heated hydrocarbon atmosphere produces VGCFs. The resulting fibers derive many of their attractive properties from the high degree of graphite crystalline phase that is produced. Individual fibers range in size from 100 microns (µm) to several centimeters long, and from 0.2 µm to 30 µm in diameter. These size differences, along with the ability to combine fibers in several bulk shapes (from a cottonball-shaped tangle to a paper-like sheet), allow Applied Sciences to tailor the fibers' properties for many uses. The ability to coat the fibers with other materials provides further flexibility.